Guaranteed Minimum Price Contracts for Some, an Insurance for Others?

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Abstract— **This paper analyzes the impact of guaranteed minimum price contracts between sub-groups of farmers and a fair trade manufacturer on the spot market price. We focus on the fair trade concept in the coffee supply chain as an example. We analyze a three level vertical chain gathering perfectly competitive farmers upstream who offer their raw product to manufacturers who then sell finished products to a downstream retailer. Without fair trade, all the raw product is sold on the spot market. When a sub-group of farmers benefit from a guaranteed minimum price contract offered by a fair trade certifier, we show that farmers outside of this fair trade agreement may also benefit from a higher spot market price in cases of a limited overproduction.**

Keywords— **Guaranteed Minimum Price Contracts, Fair Trade, Vertical Chain.**

I. INTRODUCTION

Fair Trade is usually defined as an alternative to the traditional trade [1][2]. Its purpose is to fight against poverty setting a trade channel enabling small producers from the South to have access to markets of the northern countries. The growth of Fair Trade products is based both on the small producers' specific skills but also on northern countries' consumers who are sensitive to this initiative. The label (FLO) is acknowledged at an international level and gather manufacturers who offer a guaranteed minimum price contract to small farmers. Today, most of the farmers involved in the Fair Trade market sells only a small part of their production through the Fair Trade channel, around 20% [3]; the rest is sold on the traditional market at the spot market price.

However, Bowen (2001) [4] notes that: "Most producers only sell a small part of their total production to the Fair Trade market. The rest is sold under the usual conditions to the mainstream market. However, by paying a fair price for even a small part of production, there is often a snowball effect on prices paid for the rest of production. As Alternative Trading Organizations buy up part of production at a higher price, this reduces the availability of products to middlemen who are then forced to offer higher prices to obtain sufficient quantities. This effect has been experienced in the case of honey sales in Chiapas in Mexico, Brazil nuts in Peru, cocoa in Bolivia, tea in Zimbabwe etc. This means that not only is it possible for producers who are lucky enough to have made contact with Fair Trade outlets to sell all their production at better prices, but other producers in the region, often equally marginalized, benefit also." ([4], p.31). This paragraph of the European Fair Trade Association yearbook perfectly exposes the main insight of this article. Indeed, we bring here theoretical grounds to the idea that Fair Trade may not only benefit to the farmers involved in the fair trade but also to other farmers thanks to a positive indirect effect on the spot market price.

This report was not clearly established in the coffee market case, where chronical overproduction exists. Spot market prices for coffee are regularly decreasing at the New-York stock exchange since the suppression of the International Coffee Organization (ICO) agreements on export quotas, excepted in 1994 and in 1997 when the harvest were unusually low because of the frost on Brazilian crops. In particular, between December 2000 and May 2004, the monthly averages of ICO indicator prices for a Colombian mild arabica varied from 58,10 to 78,25 US cents per lb, whereas costs of production were estimated between 60 and 80 US cents per lb (source: Web site of the ICO). Beside, there is a strong unbalance of power between a large number of small farmers and a few large roasters. Five biggest roasters of the market buy almost half of the green coffee beans world production: Kraft (13%), Nestlé (13%), Sara Lee (10%), Procter&Gamble (4%), Tchibo (4%) [5].

The balance of power being unfavorable to small farmers, Fair Trade clearly appears as an insurance against the risk of overproduction threatening their revenue. Guaranteed minimum price contracts (henceforth denoted GMP) thus sustain the price level for small farmers of a Fair Trade association, but by diverting part of the production from the traditional market, this insurance may also have side effects on the equilibrium spot market. The goal of this article is to identify conditions such that GMP contracts offered to a group of farmers increase the spot market price.

Several articles of industrial organization theory study the influence of contracts between sub-groups of producers and retailers on the spot market price. These articles usually differ according to the type of contract considered or to the market structure at each level. In general, as these contracts affect both the offer and the demand, their effect on the spot market price is ambiguous. Xia and Sexton (2004) [6] focus on the cattle market and show that Top-Of-the-Market-Pricing (TOMP) contracts between cattle sellers and packers may refrain buyers from competing aggressively. TOMP clauses specify that a cattle producer will deliver a given quantity to the buyer at a base price set at the highest spot market price paid for cattle during a comparison period. In their paper sellers are price-takers while buyers are competing imperfectly and behave strategically. However, buyers have no market power on the final market and sell at a given price. In their model, a group of sellers accepts the TOMP contracts from buyers and these clauses enables buyers to commit not to competing too aggressively with each other which relaxes competition, reduces quantities and finally lowers the spot market price.

We focus on the coffee market, a key product for Fair Trade and analyze the effect of the development of a Fair Trade channel who offers a GMP contract to part of the farmers. The coffee industry is more complex than the vertical industry analyzed by [6]We distinguish three main actors: Perfectly competitive farmers of green coffee at the upstream level, an oligopoly of roasters who transform and produce the finish coffee at the intermediary level, and a downstream monopsonist retailer who sells coffee to consumers.

This article first determines, as a benchmark, the spot market price among roasters and green coffee farmers taking into account the strategic interactions among the three levels of the channel. We then introduce a Fair Trade channel who offers small upstream farmers a GMP clause as an insurance in the bad state of nature, i.e, in case of overproduction. We then study the effects of the introduction of this channel on the spot market price. In our paper, the introduction of a Fair Trade channel is both a GMP clause offered to farmers and a disintermediation process, as the green coffee is no more transformed by the powerful roasters but by non strategic roasters acknowledged by the Fair Trade label. In this framework, our article shows that the introduction of a Fair Trade channel may raise the spot market price. This result confirms the report of Fair Trade Organizations [4] thus showing that small farmers not directly involved in Fair Trade may also benefit from it.

II. THE MODEL

A. The Market Structure

We analyse a three level vertical chain gathering farmers, manufacturers and a retailer. At the upstream level, farmers are perfectly competitive and offer their raw product to manufacturers. We normalize their production cost to zero. In the processing industry, manufacturers constitutes an oligopoly of size ($n \geq 1$) and they sell their finished product to a downstream monopsonist retailer who sells the goods to consumers. Their cost is limited to their supply in input in the spot market, all other production costs being normalized to zero. We consider that the retailer is a monopsonist in order to reflect the high concentration in the retail sector. Again retail cost are normalized to zero.[1] When there is a Fair Trade channel, the retailer can sell the Fair Trade product, as well as the n national brands, if it is profitable for her.

[1]A recent paper analyzed a similar vertical industry framework [7]. They mention that empirically, this framework is consistent with available studies of market structure in the food industry both in Europe and US.

This framework aims at stylising the main characteristics of the coffee industry. Upstream farmers are then coffee green beans producers, manufacturers who hold the national brands are those who transform beans into ready-to-drink beverage for consumers (in general roast, instant or decaffeinated coffee). An oligopoly is also a good representation of manufacturers in the coffee processing industry.

B. The Demand

The consumers may differ in their product preferences. [2] Given the n brands offered in the market, we assume that the representative consumer utility function is:

$$U(q_1,\dots,q_k,\dots,q_n)=v\sum_{i=1}^{n}q_i-\frac{n}{2}\left((1-\beta)\sum_{i=1}^{n}q_i^2+\frac{\beta}{n}\left(\sum_{i=1}^{n}q_i\right)^2\right), \quad (1)$$

where $v>0$ is a measure of the market size and q_i is the quantity of product i sold by the retailer. The parameter $\beta\in[0,1]$ is a measure for product differentiation: The higher β, the closer the products are substitutes. This formulation due to Shubik-Levitan (1980) [9] ensures that the parameter β only captures product differentiation and has no effect on the market size.[3]

Let p_k be the price charged by the retailer for the product k. Solving $\partial U/\partial q_k=p_k$ for $k=1,\dots,n$, we obtain the following inverse and direct demand function:

$$p_k=v-\left(n(1-\beta)q_k+\beta\sum_{i=1}^{n}q_i\right) \quad (2)$$

and $$q_k=\frac{1}{n}\left(v-\frac{p_k}{1-\beta}+\frac{\beta}{(1-\beta)n}\sum_{i=1}^{n}p_i\right). \quad (3)$$

[2] We do not introduce any specific difference between consumers' preferences about the possible Fair Trade characteristic of the product. See [8] for an analysis of this question.

[3] See [10] for details.

C. The Game

We analyse successively two cases absent and with the Fair Trade channel. Without Fair Trade channel the game is the following:

- Stage 1: Farmers incur their production cost (normalized to zero) and then the level of the harvest is revealed: $\widetilde{R}\rightarrow U_{[0,\frac{v}{2}]}$.
- Stage 2: Offer and demand determine the spot market price for raw products c.
- Stage 3: The n brand manufacturers set their wholesale price w_k, with $k\in[1,\dots,n]$, maximizing their profit.
- Stage 4: The retailer accepts or refuses each manufacturer's contract and sets her price p_k for each selected brand k on the final market.

We assume that manufacturers and retailer have no cost of production and retailing.

We then analyse the case where there is a Fair Trade product proposed by a fair trade organization. This Fair Trade product is carried by the retailer in addition to the previous n coffee brands.[4]

The "Fair Trade game" is identical to the previous game except that we add the following stage "0":

- Stage 0: The Fair Trade certifier sets his price contract *P*.

We assume the Fair Trade certifier chooses a guaranteed minimum price G that maximizes the revenue of the farmers involved in the Fair Trade and that he can not offer a price inferior to the spot market price.[5] Indeed, the Fair Trade wholesale price is defined as follows:

$$P=\max(G,c^f) \quad (4)$$

where c^f is the spot market price when there is a Fair Trade channel and G is the GMP. We solve the two games in the next section.

[4] The alternative would be to assume that the Fair Trade product must replace one of the previous *n* coffee brands sold by the retailer. However, this boils down to assume that the retailer has a capacity constraint which would dramatically change the balance of power in favor of the retailer: The latter being able to threaten credibly each manufacturer of exclusion, wholesale prices would be driven to the marginal cost of production and the manufacturers would get zero profits.

[5] More details on the certifier objectives are developed in subsection 3.2.

III. EQUILIBRIA ABSENT AND WITH FAIR TRADE

A. Equilibrium absent Fair Trade

The monopsonist multiproduct retailer chooses her final prices p_k for the $k \in [1,...,n]$ brand products maximizing her profit function:

$$\pi^D = \sum_{k=1}^{n} \left(p_k - w_k \right) q_k (p_1,..., p_n). \tag{5}$$

which gives the following optimal prices:

$$p_k = \frac{v + w_k}{2}. \tag{6}$$

Replacing (5) in (3), we obtain the quantity $q_k(w_1,...,w_n) = \frac{1}{2n}\left(v - \frac{w_k}{1-\beta} + \frac{\beta}{(1-\beta)} \frac{1}{n} \sum_{i=1}^{n} w_i \right)$ for the k brand product. For any symmetric wholesales prices, the retailer's profit is independent of n, and thus we therefore assume that the retailer chooses to carry all the products in her shelves.

Manufacturers set their wholesale price w_k in order to maximize their profit:

$$\pi_k = \left(w_k - c \right) q_k (w_1,..., w_n), \tag{7}$$

where c is the price of raw products on the spot market. We obtain:

$$w_k(c) = \frac{n(1-\beta)v + (n-\beta)c}{2n - \beta + n\beta}. \tag{8}$$

We are thus able to determine the total demand on the input market without Fair Trade:

$$D(c) = \frac{(n-\beta)(v-c)}{2(2n-\beta-n\beta)}. \tag{9}$$

From stage 1, the level of the harvest is R and thus offer and demand determine the spot market price for raw products. The equilibrium without Fair Trade is summarized in the following lemma:

Lemma 1. *On a market without a Fair Trade channel,*

- *The equilibrium spot market price for raw products is:*

$$c^* = \frac{(n-\beta)v - 2(2n-\beta-n\beta)R}{n-\beta}. \tag{10}$$

- *Equilibrium wholesale and final prices are respectively* $w_k = v - 2R$ *and* $p_k = v - R$.
- *Equilibrium retailer's and manufacturer's profits are respectively* $\pi^D = R^2$ *and* $\pi_k = \frac{2(1-\beta)R^2}{n-\beta}$.

The equilibrium spot market price increases with the potential demand, the number of manufacturers and the degree of substitutability among brands. Indeed, a higher number of manufacturers or a stronger substitutability between products leads up to a stronger competition on the intermediate market which balances the market power between farmers and manufacturers and thus improves the revenues of small farmers.

We denote the minimum spot market price, $c^*_{\min} = -\frac{n(1-\beta)v}{n-\beta}$, the value of c^* when the harvest is at its highest level ($R = \frac{v}{2}$). Note that c^* is negative for high level of the harvest. However, at the average harvest $\overline{R}$, farmers have a strictly positive expected profit ($c^*(\overline{R}) > 0$). By contrast, the equilibrium wholesale price is always positive as $R < \frac{v}{2}$ since manufacturers chooses to produce after the level of the harvest is revealed. Note that the level of yield which maximizes the total profit of the supply chain upstream level ($c^* R + n\pi_k$) is $\overline{R} = \frac{v}{4}$, the average harvest. From now on, we define the overproduction as a situation where the harvest is higher than this level $\overline{R}$.

2. Equilibrium with Fair Trade

The superscript "f" is used to denote the equilibrium outcomes in the Fair Trade case. Let p^f denote the price of the Fair Trade product and p_k^f the price of the brand coffee k in the final market.

The global quantity bought by consumers is:

$$Q^f(p_1^f,\dots,p_n^f,p^f)=\sum_{k=1}^{n} q_k^f + q^f = v-\frac{\sum_{k=1}^{n} p_k^f + p^f}{n+1}, \tag{11}$$

with

$$q_k^f(p_1^f,\dots,p_n^f,p^f)=\tfrac{1}{n+1}\left(v-\tfrac{p_k^f}{1-\beta}+\tfrac{\beta}{1-\beta}\tfrac{1}{n+1}\left(\sum_{k=1}^{n} p_k^f + p^f\right)\right)$$

the quantity sold by the brand k when there is a Fair Trade channel and

$$q^f(p_1^f,\dots,p_n^f,p^f)=\tfrac{1}{n+1}\left(v-\tfrac{p^f}{1-\beta}+\tfrac{\beta}{1-\beta}\tfrac{1}{n+1}\left(\sum_{k=1}^{n} p_k^f + p^f\right)\right)$$

the quantity of Fair Trade product sold.

In the last stage, the retailer maximizes her profit by choosing the retail prices of all products. Her programme is the following:

$$\max_{p_1^f,\dots,p_n^f,p^f} \pi^D=\sum_{k=1}^{n}\left(p_k^f-w_k^f\right)q_k^f+(p^f-P)q^f. \tag{12}$$

The solution is:

$$p^f(P)=\frac{v+P}{2} \quad \text{and} \quad p_k^f(w_k^f)=\frac{v+w_k^f}{2} \quad \forall k=1,\dots,n. \tag{13}$$

The retailer is free to list the Fair Trade product or not. She thus compares profits obtained in the two cases and carries the Fair Trade product only if:

$$\pi^{Df}\geq\pi^D. \tag{14}$$

Replacing (13) into the individual quantities above, the n brand manufacturers set their wholesale price maximizing their individual profit and considering the level of Fair Trade price P as given:

$$\max_{w_k^f}\pi_k=(w_k^f-c^f)q_k^f(w_1^f,\dots,w_n^f,P) \tag{15}$$

We thus obtain:

$$w_k^f(P,c)=\begin{cases} w_k(c) & \text{if} \quad c<\underline{c}_f(P). \\ \dfrac{(1-\beta)(n+1)v+\beta P+(n+1-\beta)c}{(2-\beta)(n+1)} & \text{if} \quad \underline{c}_f(P)<c<\bar{c}_k(P). \\ 0 & \text{if} \quad c>\bar{c}_k(P). \end{cases} \tag{16}$$

If $c<\underline{c}_f(P)$, the spot market price for raw product and the retail prices of products $k=1,\dots,n$ are so low relatively to the Fair Trade price P that the retailer does not sell the Fair Trade product and the wholesale price is the one derived from the benchmark model. If $\underline{c}_f(P)<c<\bar{c}_k(P)$,[6] all products are sold which is the interesting case for our purpose.

Demand on the input market may arise both from brand manufacturers, nq_k^f and from the Fair Trade channel $q^f(P,c)$. The level of the harvest is R, so that supply and demand determine the spot market price for raw product:

Lemma 2. *On a market with a Fair Trade channel, the sub-game equilibrium spot market price for raw products c^f depends on the Fair Trade price P.*

1. If $P\leq v-2(n+1-n\beta)R$, the retailer sells only the Fair Trade product and $\pi^{Df}(P)=\frac{R(v-P)}{2}>\pi^D$.

2. If $v-2(n+1-n\beta)R<P<v-2\beta R$, the retailer sells all the products,

$$c^f(P)=\tfrac{(n+1)(n+2-\beta)v-(2(n+1)-\beta)P-2(n+1)^2(2-\beta)R}{n(n+1-\beta)} \quad \textit{and}$$

$$\pi^{Df}(P)=R^2+\tfrac{(v-P-2R)^2}{4n(1-\beta)}>\pi^D.$$

3. If $P\geq v-2\beta R$, the retailer sells only the n brand products, $c^f(P)=c^*$ and $\pi^{Df}(P)=R^2$.

It is clear that the equilibrium spot market price when it exists is decreasing with the level of the harvest R.

Proposition 1. *When the Fair Trade product is sold in addition to the n brand products, the spot market price, $c^f(P)$, decreases with the level of the GMP on the Fair Trade channel, P.*

In stage 2, the equilibrium condition between demand and supply is given by the following equation:

$$R-q^f(c,P)=nq_k^f(c,P) \tag{17}$$

When the Fair Trade price, P, is higher, the final Fair Trade price, $p^f(P)$, increases. Thus, quantities of Fair Trade product sold in the final market are lower. The first outcome is that the demand on the

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[6] With $\underline{c}_f(P)=\frac{(2(n+1)^2-(n+1)(n+3)\beta+\beta^2)P-(1-\beta)(n+1)(2(n+1)-\beta)v}{n\beta(n+1-\beta)}$ and $\bar{c}_k(P)=\frac{(1-\beta)(n+1)v+\beta P}{n+1-n\beta}$.

intermediate market for brand products (nq_k^f) increases. The second effect is that, for the same total harvest, the supply on the intermediate market $(R-q^f)$ also increases. But the supply effect is higher than the demand effect. Indeed, $-\frac{\partial q^f(P,c)}{\partial P} > \frac{\partial nq_k^f(P,c)}{\partial P} > 0$. Thus the equilibrium spot market price decreases.

We define c_0^f which is uniquely defined by the following equality[7]

$$R - q^f(c_0^f, P)|_{P=c_0^f} = nq_k^f(c_0^f, P)|_{P=c_0^f} \quad (18)$$

It will be used as a benchmark in the next section.

Let now turn to the Stage 0 where the Fair Trade certifier chooses the equilibrium GMP, G^*, before the nature chooses R. The Fair Trade certifier may have different objectives.[8] We assume here that G^* maximizes the farmers' expected profits, $Gq^f(G,\overline{R})$ under the retailer's participation constraint:[9]

$$\pi^{Df} \geq \pi^D \Leftrightarrow G \leq v - 2\beta\widetilde{R}. \quad (19)$$

As already mentioned, the Fair Trade certifier does not know the level of the harvest when he sets the GMP. We first assume that the condition (19) is true at the average harvest $\overline{R}$. In this case, the Fair Trade certifier program is the following:

$$\max_G \quad Gq^f(G,\overline{R}) = \frac{P((2-\beta)v-2P)}{4(n+1)(1-\beta)}$$

$$\text{s.t.} \quad G \leq \frac{v(2-\beta)}{2}.$$

There is always an interior solution, $G_1^* = \frac{v(2-\beta)}{4}$.

However, as we have assumed that the condition (19) had to be true at the average harvest $\overline{R}$, if R is such that $G_1^* > v - 2\beta R$ $\left(R > R^{\lim} = \frac{v(2+\beta)}{8\beta}, \text{ with } R^{\lim} < \frac{v}{2} \text{ when } \beta > \frac{2}{3}\right)$ and the retailer does not sell the Fair Trade product.

To guarantee a minimum revenue to farmers involved in Fair Trade channel, the Fair Trade certifier can set G^* such that the condition (19) is guaranteed when $R = \frac{v}{2}$, the worst case of over-production. In that case, let define $G_2^* = (1-\beta)v$ as the GMP binding the condition (19) when $R = \frac{v}{2}$ and the equilibrium guaranteed minimum price G^* such that

$$G^* = Min(G_1^*, G_2^*). \quad (20)$$

In summary, as the Fair Trade price can not be lower than the spot market price, we obtain the equilibrium Fair Trade price:

$$P^* = Max(G^*, c_0^f) \quad (21)$$

The spot market price c_0^f is increasing in the potential demand, the degree of substitutability among brands, as in the benchmark case, but it is decreasing in the number of manufacturers.

When the Fair Trade harvest is not paid at the same price than on the spot market, that is, when $G_i^* > c_0^f$, the spot market price becomes:[10]

$$c^{f*} = Max(c_1^f, c_2^f) \quad (22)$$

As in the benchmark case, the spot market price c^{f*} is decreasing in R and c_1^f and c_2^f decrease in R with the same slope. More, c_2^f increases in β faster than c_1^f, with $c_2^f > c_1^f$ when $\beta > \frac{2}{3}$. The effect of the degree of substitutability checked in the benchmark case is heightened. In addition, we can show that c^{f*} is decreasing with the number of manufacturers when $R < R_n$ and increasing with n otherwise.[11] When the harvest is relatively low, a stronger competition at the intermediate level of the chain does not improve the revenues of farmers, because the spot market price is already high.

It is possible to study the overproduction threshold, $R^{\max}$, as we define it in the benchmark case (see Appendix 1 for details). We obtain that when products

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[7]Note that c_0^f is unique as $q^f(c,P) + nq_k^f(c,P)$ strictly decreases both in P and c.

[8]See [8] for a discussion about the Fair Trade certifier's objectives.

[9]We assume that if the retailer is indifferent between selling or not the Fair Trade product, she chooses to sell it.

[10]Where $c_1^f = \frac{(4(n+1)^2 - 2n\beta - \beta^2)v - 8(n+1)^2(2-\beta)R}{4n(n+1-\beta)}$ and $c_2^f = \frac{(n^2 + (1+\beta)n + (2-\beta)\beta)v - 2(n+1)^2(2-\beta)R}{n(n+1-\beta)}$

[11]The exact value of R_n is available in Appendix 2.

are weakly substitutes, the area of overproduction is limited in relation to the benchmark case. The situation is opposite with close substitute products.

IV. IMPACT OF THE INTRODUCTION OF THE FAIR TRADE CHANNEL

We here compare results obtained when there is a Fair Trade channel with the ones of the benchmark model, in terms of spot market price and profits.

A. *Spot market price*

Figure 1 represents equilibrium spot market prices with and absent Fair Trade in the map (R, c). The black line in this figure depicts the spot market price in a market without Fair Trade c^* as a function of the harvest R. The red curve shows the spot market price in a market where there is a Fair Trade channel c^f, which is equal to c_0^f when $R < R_0$ and c^{f*} otherwise. The dashed curve represents the Fair Trade price P^*, the wholesale price paid to producers involved in the Fair Trade certification system.

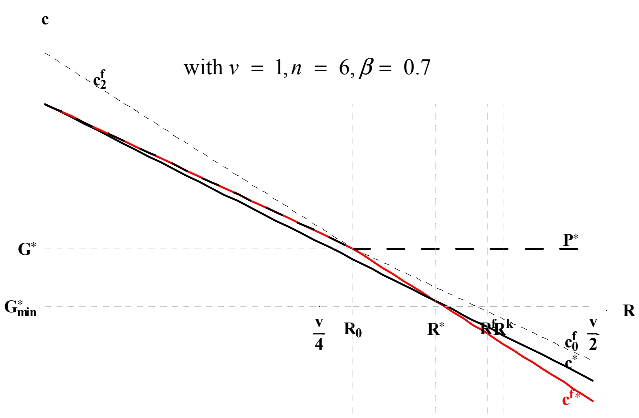

Fig. 1 Spot market prices and Fair Trade price

Let first consider the case where R is low and $P^* = c_0^f$ and second the case where R is high and $P^* = G^*$.

- When R is low $(R < R_0)$,[12] $P^* = c_0^f$.

In that case, farmers have the same revenue either inside the Fair Trade channel or on the spot market; all farmers sell at the same spot market price c_0^f. Absent the Fair Trade channel, farmers sell their production at the spot market price c^*. Comparing the equilibrium spot market price in both situations, we obtain the following lemma:

Lemma 3. *We show that* $c_0^f > c^*$.

Proof. See Appendix 3. □

We thus obtain the following proposition:

Proposition 2. *When R is low, revenue of all farmers are increased by the introduction of a Fair Trade channel. The benefit is the same for Fair Trade farmers and outsiders.*

This result is due to the fact that there is no intermediary for the Fair Trade product. The insight is as follows: With Fair Trade, total demand, that is, the sum of the demand on the spot market and the demand within the Fair Trade channel, is strictly higher than the demand absent the Fair Trade channel. Indeed, the wholesale price paid by the retailer for the Fair Trade product $P^* = c_0^f$ is lower than the wholesale price paid to manufacturers, w_k^f. Thus, the final price of the Fair Trade product, p^f, is lower than the final price of each brand product, p_k^f which increases the total demand with the Fair Trade channel. Note that this "no intermediary" effect would also appear if the Fair Trade product was replacing one of the n brands in the retailer's shelves; this result is not due to the fact that one more product is sold on the final market.

- If R is high ($R \geq R_0$), $P^* = G^*$.

In that case the spot market price when there is a Fair Trade channel is c^{f*} and farmers inside the Fair Trade channel obtain a revenue that is strictly higher

[12]The exact value of R_0 is available in Appendix 2.

than those who sell on the spot market. Absent the Fair Trade, all the farmers sell the raw product at the spot market price c^*. Both c^{f*} and c^* strictly decrease in R. their comparison leads to the following lemma:

Lemma 4. *There exists a threshold* R^* *such that:*[13] $c^{f*} \geq c^*$ *if* $R \geq R^*$ *and* $c^{f*} < c^*$ *if* $R > R^*$.

Proof. See Appendix 4. □

Proposition 3. *If overproduction is rather limited (*$R < R^*$*) the introduction of a Fair Trade channel increases the equilibrium spot market price paid to farmers outside the Fair Trade.*

The Fair Trade farmers always have a greater benefit from the introduction of the Fair Trade channel than outsiders.

Nonetheless farmers associated to the Fair Trade benefit form a greater revenue but also all farmers outside of the Fair Trade channel have a greater revenue. This result perfectly sustains the observation of Bowen on "the snowball effect" of Fair Trade that we have described in introduction. The existence of a parallel channel in a supply chain benefits all producers in terms of price when the harvest is not too high.

We can note that when the differentiation parameter, β tends towards 1, R_{0i} tends towards $\frac{v}{2}$. Thus, when all brands and products are highly substitutable, the spot market price is always greater when there is a Fair Trade channel.

Note also that the threshold R^* is higher than the overproduction threshold $R^{\max}$. This means that the Fair Trade channel is harmful for farmers not involved in this parallel channel only when there is a heavy overproduction.

To explain these results, we detail the demand and supply of raw product, which determine the spot market price. In the model with a parallel channel, when $G^* > c_0^f$, that is, $R \geq R_0$, in the Stage 2 of the game, we can rewrite the Equation (17) as

$$\begin{aligned} &R - q^f(c,G^*) = nq_k^f(c,G^*) \\ &\Leftrightarrow R = nq_k^f(c,G^*) + q^f(c,G^*) = D^f(c,G^*) \end{aligned} \tag{23}$$

If the supply R is greater than R_*, the demand in a market without a parallel channel, $D(c)$ (Equation (9)), is higher than the total demand in a market with this parallel channel, $D^f(c,G^*)$; thus, the spot market price is higher in the first kind of market. Figure 2 depicts the total demand functions in the (c,R) map. The red line is the total demand function when there is a Fair Trade channel and the green line the total demand function without the Fair Trade channel.

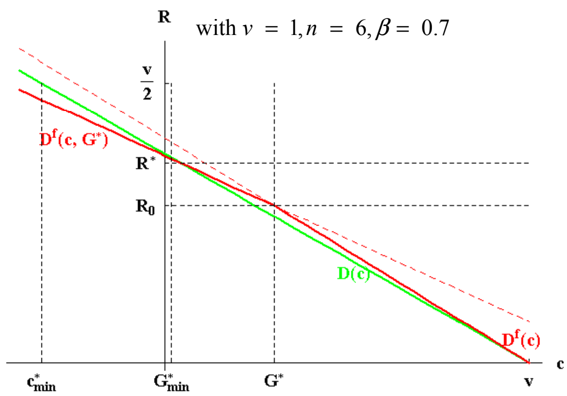

Fig. 2 Total demand functions

When the Fair Trade farmers are paid the GMP, G^*, there are two different prices for the raw product, $c^{f*} < G^*$, related to the two specific demands, the spot market demand, $nq_k^f(c,G^*)$, and the Fair Trade channel demand, $q^f(c,G^*)$. The latter is increasing in c; the cross price elasticity of the demand is positive. And finally, the total demand function, $D^f(c,G^*)$, is less sensitive to the spot market price: $\left|\frac{\partial D^f(c,G^*)}{\partial c}\right| < \left|\frac{\partial D^f(c)}{\partial c}\right|$ with $D^f(c) = D^f(c,G^*)|_{G^*=c}$, more $\left|\frac{\partial D^f(c,G^*)}{\partial c}\right| < \left|\frac{\partial D(c)}{\partial c}\right|$ (see Figure 2). This is the negative "demand sensitivity" effect : the slope of the total

[13] The exact value of R^* is available in Appendix 2.

demand function $D^f(c,G^*)$ in Figure 2. For a given of the harvest, this induces a decrease of the spot market price.[14]

There is a second new effect we called the "GMP" effect, related to the fact that $\left|\frac{\partial D^f(c,G^*)}{\partial G^*}\right| < 0$: the level of the total demand function $D^f(c,G^*)$ in Figure 2. Indeed, when the level of harvest is high ($R > Bv$),[15] the Fair Trade final price is higher than the brand final price because the Fair Trade wholesale price G^* is much higher than the spot market price, c^{f*}, and than each wholesale price of the brand product. This induces a decrease of the total demand.

And finally, the positive effect of the lack of intermediary in the parallel channel is counterbalanced by this negative GMP effect and by the negative demand sensitivity effect.

We can define the minimum GMP, $G^*_{\min}$, defined as

$$D(c^*_{\min}) = D^f(c^*_{\min}, G^*_{\min}) \quad (24)$$

$$\Leftrightarrow \quad G^*_{\min} = \frac{n\beta(1-\beta)v}{(n-\beta)(2n+2-\beta)} > 0, \quad (25)$$

such that whatever the level of harvest, the spot market price with a parallel channel is higher than the spot market price without a parallel channel. Thus, the "demand sensitive effect" can be cancelled by the choice of a low GMP.

B. *Profits*

Concerning the profits, the retailer's profit is always greater in a market with one Fair Trade product than without. This is due to the fact that the Fair Trade certifier observes the condition (19) when he sets the GMP. In fact, absent Fair Trade, the retailer's margin is equal to R. With Fair Trade, when $R < Bv$, the retailer's margin on brand products is lower then R, but her margin on Fair Trade product is higher than R. The inequalities are opposite when $R > Bv$.

For the manufacturers, we can show that when their individual profit is higher with Fair Trade than without when the harvest is higher than a threshold R^k.[16] This is due to the fact that $c^{f^*} < c^*$ and that the equilibrium quantities of brand products is increasing in R when $R > R_0$. Even if there is an extra product, the manufacturers can benefit of the parallel channel through the GMP effect and the demand sensitive effect.

To compare the situation of small producers, we need to compare prices as done previously but also quantities sold. Figure 3 represents the market share of the Fair Trade product relatively to other products. The quantities sold of Fair Trade product are maximal when the spot market price c_0^f is equal to the guaranteed minimum price G^*, that is, when $R = R_0$.

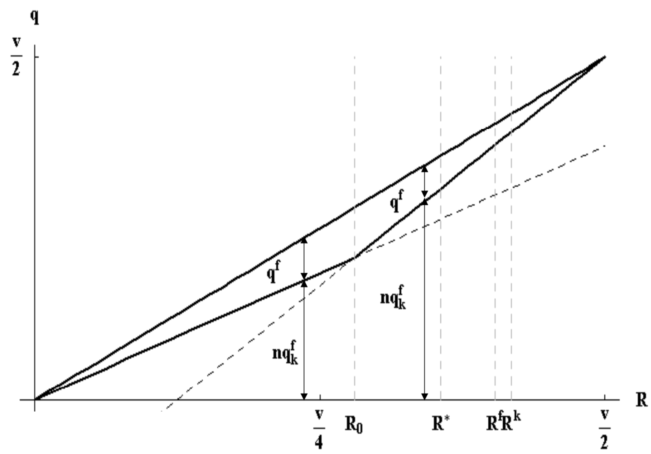

Fig. 3 Quantities

We now compare the total profits of all farmers with Fair Trade and the farmers' profits absent Fair Trade.

Proposition 4. *Upstream farmers' total profits are higher when there exists a parallel channel with a*

[14]Nevertheless, this effect can be view as a good thing for farmers not involved in the parallel channel, because the spot market price is less sensitive to variations of the harvest.

[15]See Appendix 2 for the exact value of B.

[16]The exact value of R^k is available in Appendix 2.

GMP than in a market without a parallel channel if the harvest is not too high ($R < R^f$).[17]

As $R^f > R^*$, we can say that the existence of a specific channel in a supply chain benefits all farmers when the overproduction is not calamitous. This is all the more true as the different brand products and the Fair Trade product are highly substitutable.

V. CONCLUSION

This article is a theoretical contribution to a question surrounding the existence of a Fair Trade channel in the supply chain of a good. A general critics against Fair Trade is that only a few may benefit from a better situation and it is likely that it will be to the detriment of other small producers who are excluded from this channel. Some Fair Trade organizations claim that by paying a higher price for a part of the harvest, there is a snowball effect on spot market price paid for the rest of the production in the mainstream market.

We have first shown that when there is not a too large overproduction, producers not involved in the Fair Trade concept obtain a higher spot market price for their harvest than in the case where there is no Fair Trade channel. This conclusion clearly supports the argument underlined by Fair Trade organizations. This is due to the fact that there is no intermediary in the Fair Trade channel.

However, for strong overproduction, Fair Trade may have a negative indirect effect by lowering the spot market price paid to farmers not involved in the Fair Trade channel. This is due to the GMP and that the total final demand is less sensitive to the spot market price, because there are two wholesale prices for the raw product, the spot market price.

Besides, we have shown that if the wholesale price of the Fair Trade product is higher, that is, if the Fair Trade certifier sets a higher GMP, the spot market price decreases. More, the certifier could choose a low GMP in order to favour all farmers by eliminating the GMP effect on the total demand.

Our results can be generalized to all supply chains where there exists a specific channel which offers a contract to some producers with a guaranteed minimum price clause and reduces the number of intermediaries.

VI. APPENDIXES

A. *Overproduction*

We show that

when $c^{f*} = c_1^f$, i.e., $\beta < \frac{2}{3}$, $\quad R^{\max} = \begin{cases} R_0^{\max} < \overline{R} & \text{if } n < \tilde{n}(\beta) \\ R_1^{\max} > \overline{R} & \text{if } n > \tilde{n}(\beta) \end{cases}$

when $c^{f*} = c_2^f$, i.e., $\beta \geq \frac{2}{3}$, $\quad R^{\max} = R_0^{\max} < \overline{R}$

with $R_0^{\max} = \frac{(n+2-\beta)^2 v}{4(n^2+(5-3\beta)n+(2-\beta)^2)}$, $R_1^{\max} = \frac{(2n(1-\beta)+2+\beta)v}{8(n+1-n\beta)}$ and $\tilde{n}(\beta) < 2$ when $\beta < 5-\sqrt{19} = 0.641101$.

B. *Harvest thresholds*

Let $B = Max\left(\frac{2+\beta}{8}, \frac{\beta}{2}\right)$.

$B = \frac{2+\beta}{8}$ when $\beta < \frac{2}{3}$ and $B = \frac{\beta}{2}$ when $\beta \geq \frac{2}{3}$.

- Let R_n such that $\frac{\partial c^{f*}(R_n)}{\partial n} = 0$.

$$R_n = Bv\frac{(2(1+n)^2 - (3+2n)\beta + \beta^2)}{(n+1)(2-\beta)(n+1+(n-1)\beta)} < Bv$$

- Let R_0 such that $G^* = c_0^f(R_0)$

$$R_0 = Bv\frac{(n+2-\beta)}{(n+1)(2-\beta)} < Bv$$

- Let R^* such that $c^{f*}(R^*) = c^*(R^*)$

$$R^* = Bv\frac{(2(n+1)-\beta)(n-\beta)}{2n^2+(2-4\beta+\beta^2)n-(2-\beta)\beta} > Bv,$$

- In the model with one Fair Trade product, the profit of the manufacturer k is equal to

$$\pi_k^f = \begin{cases} \pi_{k0}^f(R) = \frac{2(n+1-\beta)(1-\beta)R^2}{(n+2-\beta)^2} & \text{when } R < R_0 \\ \pi_k^{f*}(R) = \frac{2[Bv-(n+1-n\beta)R]^2}{(1-\beta)(n+1-\beta)n^2} & \text{when } R \geq R_0 \end{cases}$$

Let R^k such that $\pi_k^{f*}(R^k) = \pi_k(R^k)$

$$R^k = Bv\frac{n-\beta}{(n+1-n\beta)(n-\beta)-(1-\beta)n\sqrt{(n+1-\beta)(n-\beta)}} > Bv.$$

[17] The exact value of R^f is available in Appendix 2.

- In the model with one Fair Trade product, the profit of all farmers is equal to

$$\pi^{Pf} = \begin{cases} \pi_0^f(R) = \frac{R[(n+2-\beta)v-2(n+1)(2-\beta)R]}{(n+2-\beta)} & \text{when } R < R_0 \\ \pi^{f*}(R) & \text{when } R \geq R_0 \end{cases}$$

We can show that $\pi_0^f(R) < c^* R, \forall R < R_0$.

Let R^f such that $\pi^{f*}(R^f) = c^* R^f$

$$R^f = Bv\frac{(n+1)(n-\beta)(2-\beta)+(1-\beta)n\sqrt{2(n-\beta)(n+1-\beta)}}{(2-\beta^2)n^2+2(1-\beta)^2 n-\beta(2-\beta)}$$

with $R^f > R^*$.

C. Proof of Lemma 3

From equilibria spot market prices absent Fair Trade and with Fair Trade, we obtain that

$$\begin{aligned} & c_0^f(R) && > && c^*(R), \quad \forall R \\ \Leftrightarrow \quad & v-\frac{2(n+1)(2-\beta)R}{n+2-\beta} && > && v-\frac{2(2n-\beta-n\beta)R}{n-\beta} \\ \Leftrightarrow \quad & 2n(1-\beta) && > && 0 \end{aligned}$$

D. Proof of Lemma 4

From equilibria spot market prices absent Fair Trade and with Fair Trade, we obtain that

$$\begin{aligned} & c^{f*}(R) && > && c^*(R) \\ \Leftrightarrow \quad & \max(c_1^f, c_2^f) && > && v-\frac{2(2n-\beta-n\beta)R}{n-\beta} \qquad (32) \\ \Leftrightarrow \quad & R && < && R^* \end{aligned}$$

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